Key

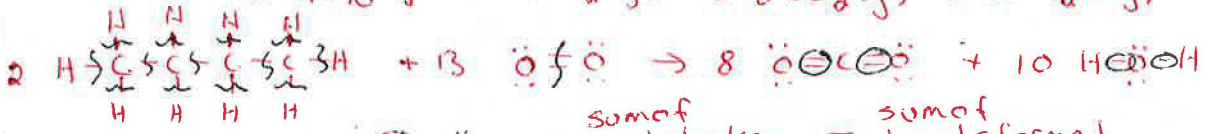
CHM General Chemistry I **Exam #3 Chapter 8 Review Sheet**

Bond Enthalpy Review

Note: You will be given a table of ΔH bonds

Estimate the ΔH_{rxn} for the combustion reaction of butane (C_4H_{10}). Is the reaction exothermic or endothermic? $2\,C_4H_{10}(g) + 13\,O_2(g) \rightarrow 8\,CO_2(g) + 10\,H_2O(g)$ *Balance*

Draw Lewis dot structures



① Bonds broken

2 x 10 mol C-H bonds = 20 mol C-H

2 x 3 mol C-C = 6 mol C-C

13 x 1 mol O=O = 13 mol O=O

② Bonds formed

8 x 2 mol C=O = 16 mol C=O

10 x 2 mol H-O = 20 mol H-O

③ ΔH_{rxn} = sum of bonds broken − sum of bonds formed

$\Delta H_{rxn} = [(20\,mol \times C\text{-}H) + (6\,mol \times C\text{-}C) + (13\,mol\ O=O)] - [(16\,mol \times C=O) + (20\,mol \times H\text{-}O)]$

$= \left[\left(20\,mol \times \frac{413\,kJ}{mol}\right) + \left(6\,mol \times \frac{348\,kJ}{mol}\right) + \left(13\,mol \times \frac{495\,kJ}{mol}\right)\right] - \left[\left(16\,mol \times \frac{799\,kJ}{mol}\right) + \left(20\,mol \times \frac{467\,kJ}{mol}\right)\right]$

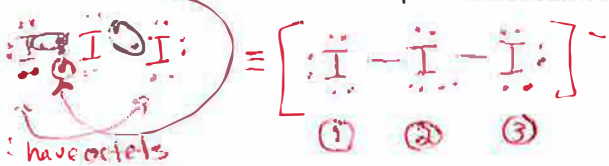
$= [16783\,kJ] - [22,124\,kJ]$

$\Delta H_{rxn} = -5,341\,kJ$

exothermic

Lewis Dot/Resonance Structure Review

1. Draw the most plausible Lewis dot structure of I_3^-. Calculate the formal charge on each I.



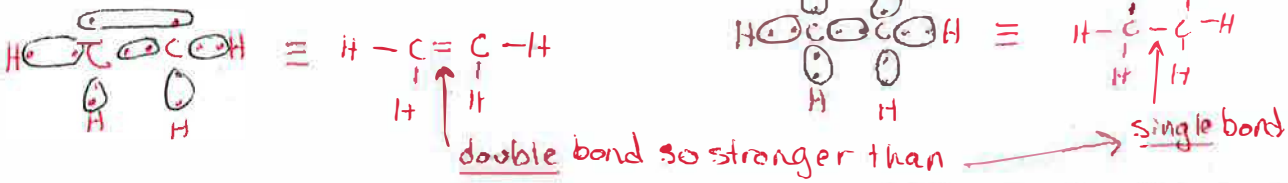
*Note: have octets

add 1 e⁻

	①	②	③
valence	7	7	7
bonding	½(2) = 1	½(4) = 2	½(2) = 1
non-bonding	6	6	6
formal charge	0	−1	0

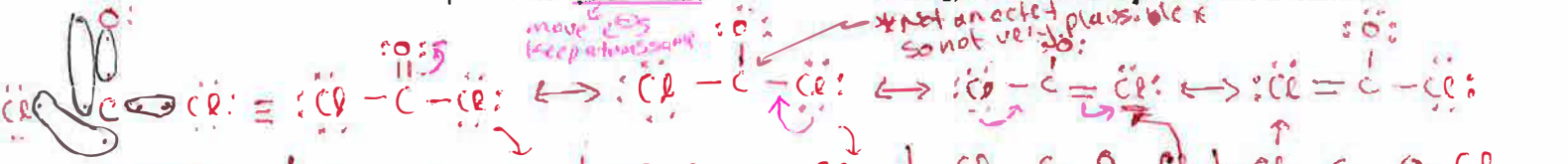
So

2. Draw the Lewis dot structure of ethylene (H_2CCH_2). What is the bond order (single, double, triple, quadruple) between the carbons? Would you predict a stronger of weaker bond versus ethane (H_3CCH_3)?



double bond so stronger than → single bond

3. Draw three plausible resonance structure of $COCl_2$, rationalize which should be most



move lone pairs

Not an octet plausible so not very stable

	Cl C O Cl	Cl C O Cl	Cl C O Cl	Cl C O Cl
valence	7 4 6 7	7 4 6 7	7 4 6 7	7 4 6 7
bonding	½(2)=1 ½(8)=4 ½(4)=2 ½(0)=0	½(2)=1 ½(6)=3 ½(2)=1 ½(0)=0	½(2)=1 ½(8)=4 ½(8)=4 ½(4)=2	½(4)=2 ½(8)=4 ½(2)=1 ½(0)=0
non-bonding	6 0 4 6	6 0 6 6	6 0 6 4	4 0 6 6
formal charge	0 0 0 0	0 +1 −1 0	0 0 −1 +1	+1 0 −1 0

*most dominant b/c least charged & all atoms have an octet

aka all formal charge are closest to zero

CHM113 General Chemistry I **Exam #3 Chapter 8 Review Sheet**

Periodic Trends

$E_{lat} = \frac{KQ_1Q_2}{d}$

1) Which of the following compounds has the largest lattice enthalpy?

a. NaCl b. K_2O c. NaF d. KCl e. CaO ← largest charges ∴ largest

2) Rank the following in terms of increasing bond polarity: C–F, N–Cl, H–Br, O–H.

FOClNBrISCH ↑EN

N-Cl < H-Br < O-H < C-F

least difference in EN → greatest difference in EN

3) Which of the following is the least electronegative element?

a. N b. Cl c. Mg d. H

4) Indicate which atom/ion has the highest value of electronegativity

$_{37}Rb$ or $_{53}I$ or $_{35}Br$

FOClNBrISCH